



General

Guideline Title

Antibiotics for early-onset neonatal infection. Antibiotics for the prevention and treatment of early-onset neonatal infection.

Bibliographic Source(s)

National Collaborating Centre for Women's and Children's Health. Antibiotics for early-onset neonatal infection. London (UK): National Institute for Health and Clinical Excellence (NICE); 2012 Aug. 40 p. (Clinical guideline; no. 149).

Guideline Status

This is the current release of the guideline.

Recommendations

Major Recommendations

Note from the National Guideline Clearinghouse (NGC): This guideline was developed by the National Collaborating Centre for Women's and Children's Health, (NCC-WCH) on behalf of the National Institute for Health and Clinical Excellence (NICE). See the "Availability of Companion Documents" field for the full version of this guidance.

This guideline should be read in conjunction with:

- [Caesarean section](#) (see the NGC summary of NICE clinical guideline 132).
- Bacterial meningitis and meningococcal septicaemia (NICE clinical guideline 102).
- [Induction of labour](#) (see the NGC summary of NICE clinical guideline 70).
- Antenatal care (NICE clinical guideline 62).
- [Intrapartum care](#) (NICE clinical guideline 55).
- [Urinary tract infection in children](#) (NICE clinical guideline 54).
- [Feverish illness in children](#) (NICE clinical guideline 47).
- [Postnatal care](#) (NICE clinical guideline 37).

Unless otherwise indicated, all references to infection in the guideline recommendations refer to early-onset neonatal infection (that is, onset of infection within 72 hours of birth).

Terms Used in This Guideline

Peak gentamicin concentration: The level of gentamicin in the baby's bloodstream shortly after administration. The blood sample is usually taken about 1 hour after giving the drug. High peak concentrations of gentamicin are necessary to kill bacteria.

Therapeutic monitoring: A process of measuring the concentration of a drug in the bloodstream, to avoid excessive levels that might be associated with adverse effects or to ensure adequate levels for therapeutic effect.

Trough gentamicin concentration: The level of gentamicin in the baby's bloodstream shortly before a further dose is given. High trough gentamicin concentrations may be associated with an increased risk of adverse effects.

Information and Support

If clinical concerns about possible early-onset neonatal infection arise during pregnancy or in the first 72 hours after birth (for example, in relation to risk factors [see Table 1, below] or clinical indicators [see Table 2, below]):

- Tell the baby's parents and carers.
- Explain the reason for concern (including the nature of early-onset neonatal infection).
- Discuss the preferred options for management (for example, observation, investigations, or antibiotic treatment).
- Give the baby's parents and carers time to consider the information provided, and offer further opportunities for discussion if necessary.

If considering antibiotic treatment because of clinical concerns about possible early-onset neonatal infection, discuss:

- The rationale for the treatment
- The risks and benefits in the individual circumstances
- The observations and investigations that may be needed to guide clinical management (for example, when to stop treatment)
- The preferred antibiotic regimen and likely duration of treatment
- The impact, if any, on where the woman or her baby will be cared for

To maintain communication with a woman in labour whose baby is at increased risk of infection, healthcare professionals should involve the woman in any handover of care, either when additional expertise is brought in because of the risk of infection or during planned changes in staff. The handover should include an update about the presence of any infection. (This recommendation is adapted from the related recommendation in the section "Care throughout Labour" in NICE clinical guideline 55, [Intrapartum care](#).)

Reassure parents and carers that they will be able to continue caring for, and holding, their baby according to their wishes unless the baby is too ill to allow this. If the severity of the baby's illness means they need to change the way they care for the baby, discuss this with them.

Reassure parents and carers that babies at increased risk of, or with, early-onset neonatal infection can usually continue to breastfeed, and that every effort will be made to facilitate this. If a baby is temporarily unable to breastfeed, support the mother to express breast milk if she wishes to do so.

If the woman had group B streptococcal colonisation in a previous pregnancy but without infection in the baby, reassure her that this will not affect the management of the birth in the current pregnancy.

Offer parents and carers contact details of organisations that provide parent support, befriending, counselling, information, and advocacy. They may signpost families to other sources of help. (This recommendation is adapted from the related recommendation in the section "Long-term Management" in NICE clinical guideline 102.)

If there have been any concerns about early-onset neonatal infection before a baby is discharged, advise the parents and carers verbally and in writing that they should seek medical advice (for example, from National Health Service [NHS] Direct, their general practice, or an accident and emergency department) if they are concerned that the baby:

- Is showing abnormal behaviour (for example, inconsolable crying or listlessness), or
- Is unusually floppy, or
- Has developed difficulties with feeding or with tolerating feeds, or
- Has an abnormal temperature unexplained by environmental factors (lower than 36°C or higher than 38°C), or
- Has rapid breathing, or
- Has a change in skin colour

When the baby is discharged from the hospital or midwifery-led unit (or in the immediate postnatal period in the case of babies born at home), inform the parents and carers and the baby's general practitioner (GP), verbally and in writing, if the baby is considered to be at increased risk of infection.

If a baby has been treated for suspected or confirmed early-onset neonatal infection:

- Inform the parents and carers about potential long-term effects of the baby's illness and likely patterns of recovery, and reassure them if no problems are anticipated.
- Take account of parents' and carers' concerns when providing information and planning follow-up.

When a baby who has had a group B streptococcal infection is discharged from hospital:

- Advise the woman that if she becomes pregnant again:
 - There will be an increased risk of early-onset neonatal infection
 - She should inform her maternity care team that a previous baby has had a group B streptococcal infection
 - Antibiotics in labour will be recommended
- Inform the woman's GP in writing that there is a risk of:
 - Recurrence of group B streptococcal infection in the baby, and
 - Group B streptococcal infection in babies in future pregnancies

If the woman has had group B streptococcal colonisation in the pregnancy but without infection in the baby, inform her that if she becomes pregnant again, this will not affect the management of the birth in the next pregnancy.

For every baby about whom there has been a clinical concern regarding early-onset neonatal infection, formulate a post-discharge management plan, taking into account factors such as:

- The level of the initial clinical concern
- The presence of risk factors
- Parents' and carers' concerns

Risk Factors for Infection and Clinical Indicators of Possible Infection

Recognising Risk Factors and Clinical Indicators

Use Table 1 below to identify risk factors for early-onset neonatal infection and Table 2 below to identify clinical indicators of early-onset neonatal infection.

Use Tables 1 and 2, below to identify red flags (risk factors and clinical indicators that should prompt a high level of concern regarding early-onset neonatal infection).

Table 1. Risk factors for Early-onset Neonatal Infection, Including 'Red Flags'

Risk Factor	Red Flag
Invasive group B streptococcal infection in a previous baby	
Maternal group B streptococcal colonisation, bacteriuria, or infection in the current pregnancy	
Prelabour rupture of membranes	
Preterm birth following spontaneous labour (before 37 weeks' gestation)	
Suspected or confirmed rupture of membranes for more than 18 hours in a preterm birth	
Intrapartum fever higher than 38°C, or confirmed or suspected chorioamnionitis	
Parenteral antibiotic treatment given to the woman for confirmed or suspected invasive bacterial infection (such as septicaemia) at any time during labour, or in the 24-hour periods before and after the birth (This does not refer to intrapartum antibiotic prophylaxis)	Yes
Suspected or confirmed infection in another baby in the case of a multiple pregnancy	Yes

Table 2. Clinical Indicators of Possible Early-onset Neonatal Infection (Observations and Events in the Baby), Including 'Red Flags'

Clinical Indicator	Red Flag
Altered behaviour or responsiveness	

Clinical indicator	Red Flag
Altered muscle tone (for example, floppiness)	
Feeding difficulties (for example, feed refusal)	
Feed intolerance, including vomiting, excessive gastric aspirates, and abdominal distension	
Abnormal heart rate (bradycardia or tachycardia)	
Signs of respiratory distress	
Respiratory distress starting more than 4 hours after birth	Yes
Hypoxia (for example, central cyanosis or reduced oxygen saturation level)	
Jaundice within 24 hours of birth	
Apnoea	
Signs of neonatal encephalopathy	
Seizures	Yes
Need for cardio-pulmonary resuscitation	
Need for mechanical ventilation in a preterm baby	
Need for mechanical ventilation in a term baby	Yes
Persistent fetal circulation (persistent pulmonary hypertension)	
Temperature abnormality (lower than 36°C or higher than 38°C) unexplained by environmental factors	
Signs of shock	Yes
Unexplained excessive bleeding, thrombocytopenia, or abnormal coagulation (International Normalised Ratio greater than 2.0)	
Oliguria persisting beyond 24 hours after birth	
Altered glucose homeostasis (hypoglycaemia or hyperglycaemia)	
Metabolic acidosis (base deficit of 10 mmol/litre or greater)	
Local signs of infection (for example, affecting the skin or eye)	

Before the Birth

For women in labour identify and assess any risk factors for early-onset neonatal infection (see Table 1, above). Throughout labour monitor for the emergence of new risk factors, such as intrapartum fever higher than 38°C, or the development of chorioamnionitis.

Manage prelabour rupture of membranes at term according to the recommendations in NICE clinical guideline 55, [Intrapartum care](#)

After the Birth

If there are any risk factors for early-onset neonatal infection (see Table 1, above) or if there are clinical indicators of possible early-onset neonatal infection (see Table 2, above) perform a careful clinical assessment without delay. Review the maternal and neonatal history and carry out a physical examination of the baby including an assessment of the vital signs.

Use the following framework based on risk factors and clinical indicators, including red flags (see Tables 1 and 2, above), to direct antibiotic management decisions:

- In babies with any red flags, or with two or more 'non-red flag' risk factors or clinical indicators (see Tables 1 and 2, above), perform investigations (see the related recommendations in the section "Investigations before Starting Antibiotics in the Baby," below) and start antibiotic treatment. Do not delay starting antibiotics pending the test results (see the related recommendations in the section "Antibiotics for Suspected Infection," below).
- In babies without red flags and only one risk factor or one clinical indicator, using clinical judgement, consider:
 - Whether it is safe to withhold antibiotics, and

- Whether it is necessary to monitor the baby's vital signs and clinical condition
- If monitoring is required continue it for at least 12 hours (at 0, 1, and 2 hours and then 2-hourly for 10 hours)

In babies being monitored for possible infection:

- If clinical concern increases, consider performing necessary investigations (see the related recommendations in the section "Investigations before Starting Antibiotics in the Baby," below) and starting antibiotic treatment (see the related recommendations in the section "Antibiotics for Suspected Infection," below).
- If no further concerns arise during the period of observation reassure the family and, if the baby is to be discharged, give advice to the parents and carers (see the related recommendation in the section "Information and Support," above).

If a baby needs antibiotic treatment it should be given as soon as possible and always within 1 hour of the decision to treat.

Manage suspected bacterial meningitis according to the recommendations in NICE clinical guideline 102 (Bacterial meningitis and meningococcal septicaemia) unless the baby is already receiving care in a neonatal unit.

Manage suspected urinary tract infection according to the recommendations in NICE clinical guideline 54 [Urinary tract infection in children](#)

.

Continue routine postnatal care (see [Postnatal care](#) , NICE clinical guideline 37) for babies without risk factors (see Table 1, above) or clinical indicators of possible infection (see Table 2, above).

If maternal colonisation with group B streptococcus is first identified after the birth but within the first 72 hours of life, ask the person directly involved in the baby's care (for example, a parent, carer or healthcare professional) whether they have any concerns, identify any other risk factors present, and look for clinical indicators of infection. Use this assessment to decide on clinical management (see the related recommendation in the section "Risk Factors for Infection and Clinical Indicators of Possible Infection," above).

Intrapartum Antibiotics

Offer intrapartum antibiotic prophylaxis using intravenous benzylpenicillin to prevent early-onset neonatal infection for women who have had:

- A previous baby with an invasive group B streptococcal infection
- Group B streptococcal colonisation, bacteriuria, or infection in the current pregnancy

If the woman decides to take intrapartum antibiotic prophylaxis, give the first dose as soon as possible and continue prophylaxis until the birth of the baby.

Consider intrapartum antibiotic prophylaxis using intravenous benzylpenicillin to prevent early-onset neonatal infection for women in preterm labour if there is prelabour rupture of membranes of any duration.

Consider intrapartum antibiotic prophylaxis using intravenous benzylpenicillin to prevent early-onset neonatal infection for women in preterm labour if there is suspected or confirmed intrapartum rupture of membranes lasting more than 18 hours.

Offer benzylpenicillin as the first choice for intrapartum antibiotic prophylaxis. If the woman is allergic to penicillin, offer clindamycin unless individual group B streptococcus sensitivity results or local microbiological surveillance data indicate a different antibiotic.

Avoiding Routine Use of Antibiotics in the Baby

Do not routinely give antibiotic treatment to babies without risk factors for infection or clinical indicators or laboratory evidence of possible infection.

Investigations Before Starting Antibiotics in the Baby

When starting antibiotic treatment in babies with risk factors for infection or clinical indicators of possible infection, perform a blood culture before administering the first dose.

Measure the C-reactive protein concentration at presentation when starting antibiotic treatment in babies with risk factors for infection or clinical indicators of possible infection.

Perform a lumbar puncture to obtain a cerebrospinal fluid sample before starting antibiotics if it is thought safe to do so and:

- There is a strong clinical suspicion of infection, or

- There are clinical symptoms or signs suggesting meningitis

If performing the lumbar puncture would unduly delay starting antibiotics, perform it as soon as possible after starting antibiotics.

Do not routinely perform urine microscopy or culture as part of the investigation for early-onset neonatal infection.

Do not perform skin swab microscopy or culture as part of the investigation for early-onset neonatal infection in the absence of clinical signs of a localised infection.

Be aware that, although minor conjunctivitis with encrusting of the eyelids is common and often benign, a purulent discharge may indicate the presence of a serious infection (for example, with chlamydia or gonococcus).

In babies with a purulent eye discharge take swab samples urgently for microbiological investigation, using methods that can detect chlamydia and gonococcus. Start systemic antibiotic treatment for possible gonococcal infection while awaiting the swab microbiology results.

In babies with clinical signs of umbilical infection, such as a purulent discharge or signs of periumbilical cellulitis (for example, redness, increased skin warmth, or swelling), perform a blood culture, take a swab sample for microscopy and culture, and start antibiotic treatment with intravenous flucloxacillin and gentamicin (see the related recommendation in the section "Antibiotics for Suspected Infection," below)*. If the microbiology results indicate that the infection is not due to a Gram-negative infection, stop the gentamicin.

Antibiotics for Suspected Infection

Use intravenous benzylpenicillin with gentamicin as the first-choice antibiotic regimen for empirical treatment of suspected infection unless microbiological surveillance data reveal local bacterial resistance patterns indicating a different antibiotic.

Give benzylpenicillin in a dosage of 25 mg/kg every 12 hours†. Consider shortening the dose interval to 8-hourly based on clinical judgement (for example, if the baby appears very ill).

Give gentamicin in a starting dosage of 5 mg/kg*.

If a second dose of gentamicin is to be given (see the related recommendation in the section "Duration of Antibiotic Treatment," below) it should usually be given 36 hours after the first dose. The interval may be shortened, based on clinical judgement, for example if:

- The baby appears very ill
- The blood culture shows a Gram-negative infection

Decide on subsequent gentamicin doses and intervals taking account of blood gentamicin concentrations (see the related recommendations in the section "Therapeutic Drug Monitoring for Gentamicin," below).

Record the times of:

- Gentamicin administration
- Sampling for therapeutic monitoring

Regularly reassess the clinical condition and results of investigations in babies receiving antibiotics. Consider whether to change the antibiotic regimen taking account of:

- The baby's clinical condition (for example, if there is no improvement)
- The results of microbiological investigations
- Expert microbiological advice, taking account of local surveillance data

If there is microbiological evidence of Gram-negative bacterial sepsis, add another antibiotic to the benzylpenicillin and gentamicin regimen that is active against Gram-negative bacteria (for example, cefotaxime). If Gram-negative infection is confirmed stop benzylpenicillin.

Duration of Antibiotic Treatment

Investigations during Antibiotic Treatment

In babies given antibiotics because of risk factors for infection or clinical indicators of possible infection, measure the C-reactive protein concentration 18–24 hours after presentation.

Consider performing a lumbar puncture to obtain a cerebrospinal fluid sample in a baby who did not have a lumbar puncture at presentation who is

receiving antibiotics, if it is thought safe to do so and if the baby:

- Has a C-reactive protein concentration of 10 mg/litre or greater, or
- Has a positive blood culture, or
- Does not respond satisfactorily to antibiotic treatment

Decisions 36 Hours after Starting Antibiotic Treatment

In babies given antibiotics because of risk factors for infection or clinical indicators of possible infection, consider stopping the antibiotics at 36 hours if:

- The blood culture is negative, and
- The initial clinical suspicion of infection was not strong, and
- The baby's clinical condition is reassuring with no clinical indicators of possible infection, and
- The levels and trends of C-reactive protein concentration are reassuring

Consider establishing hospital systems to provide blood culture results 36 hours after starting antibiotics to facilitate timely discontinuation of treatment and discharge from hospital.

Clinical microbiology or paediatric infectious disease advice should be available every day from healthcare professionals with specific experience in neonatal infection.

Early-onset Neonatal Infection without Meningitis

The usual duration of antibiotic treatment for babies with a positive blood culture, and for those with a negative blood culture but in whom there has been strong suspicion of sepsis, should be 7 days. Consider continuing antibiotic treatment for more than 7 days if:

- The baby has not yet fully recovered, or
- This is advisable, based on the pathogen identified on blood culture (seek expert microbiological advice if necessary)

If continuing antibiotics for longer than 36 hours despite negative blood cultures, review the baby at least once every 24 hours. On each occasion, using clinical judgement, consider whether it is appropriate to stop antibiotic treatment, taking account of:

- The level of initial clinical suspicion of infection
- The baby's clinical progress and current condition, and
- The levels and trends of C-reactive protein concentration

Meningitis (Babies in Neonatal Units)

If a baby is in a neonatal unit and meningitis is suspected but the causative pathogen is unknown (for example, because the cerebrospinal fluid Gram stain is uninformative), treat with intravenous amoxicillin and cefotaxime.

If a baby is in a neonatal unit and meningitis is shown to be due to Gram-negative infection either by cerebrospinal fluid Gram stain or culture, stop amoxicillin and treat with cefotaxime alone.

If a baby is in a neonatal unit and meningitis is shown by cerebrospinal fluid Gram stain to be due to a Gram-positive infection, continue treatment with intravenous amoxicillin and cefotaxime while awaiting the cerebrospinal fluid culture result and seek expert microbiological advice.

If the cerebrospinal fluid culture is positive for group B streptococcus consider changing the antibiotic treatment to:

- Benzylpenicillin 50 mg/kg every 12 hours†, normally for at least 14 days, and
- Gentamicin in a starting dosage of 5 mg/kg every 36 hours*, with subsequent doses and intervals adjusted if necessary based on clinical judgement (see the related recommendation in the section "Antibiotics for Suspected Infection," above) and blood gentamicin concentrations (see the related in the section "Therapeutic Drug Monitoring for Gentamicin," below); gentamicin treatment should continue for 5 days.

If the blood culture or cerebrospinal fluid culture is positive for listeria consider stopping cefotaxime and treating with amoxicillin and gentamicin.

If the cerebrospinal fluid culture identifies a Gram-positive bacterium other than group B streptococcus or listeria seek expert microbiological advice on management.

Discharge after Antibiotic Treatment

On completing antibiotic treatment, consider prompt discharge of the baby from hospital, with support for the parents and carers and a point of contact for advice.

Therapeutic Drug Monitoring for Gentamicin

Trough Concentrations

If a second dose of gentamicin is to be given (see the related recommendation in the section "Antibiotics for Suspected Infection," above) measure the trough blood gentamicin concentration immediately before giving the second dose. Consider the trough concentration before giving a third dose of gentamicin.

Hospital services should make blood gentamicin concentrations available to healthcare professionals in time to inform the next dosage decision (for example, within 30 hours of sampling).

Consider repeating the measurement of trough concentrations immediately before every third dose of gentamicin, or more frequently if necessary (for example, if there has been concern about previous trough concentrations or renal function).

Adjust the gentamicin dose interval, aiming to achieve trough concentrations of less than 2 mg/litre. If the course of gentamicin lasts more than three doses a trough concentration of less than 1 mg/litre is advised.

If an intended trough concentration measurement is not available, do not withhold the next dose of gentamicin unless there is evidence of renal dysfunction (for example, an elevated serum urea or creatinine concentration, or anuria).

Peak Concentrations

Consider measuring peak blood gentamicin concentrations in selected babies such as in those with:

- Oedema
- Macrosomia (birthweight more than 4.5 kg)
- An unsatisfactory response to treatment
- Proven Gram-negative infection

Measure peak concentrations 1 hour after starting the gentamicin infusion.

If a baby has a Gram-negative or staphylococcal infection, consider increasing the dose of gentamicin if the peak concentration is less than 8 mg/litre.

Care Setting

Using clinical judgement, consider completing a course of intravenous antibiotics outside of hospital (for example, at home or through visits to a midwifery-led unit) in babies who are well without ongoing concerns if there is adequate local support.

When deciding on the appropriate care setting for a baby, take into account the baby's clinical needs and the competencies necessary to ensure safe and effective care (for example, the insertion and care of intravenous cannulas).

* Gentamicin is licensed for use in newborn babies. The summary of product characteristics recommends a dosage of 4–7 mg/kg/day administered in a single dose. The evidence reviewed for the guideline supports a starting dosage of 5 mg/kg every 36 hours administered in a single dose.

† Benzylpenicillin is licensed for use in newborn babies. The summary of product characteristics recommends a dosage of 50 mg/kg/day in two divided doses in babies under 1 week of age. In babies aged 1–4 weeks the dosage should be increased to 75 mg/kg/day in three divided doses, as recommended in the summary of product characteristics.

Clinical Algorithm(s)

The full version of the original guideline document includes the following algorithms:

- Intrapartum antibiotic prophylaxis
- Determine the need for antibiotic treatment in the baby
- Management of antibiotic treatment for suspected for early-onset neonatal infection
- Duration of antibiotic treatment

- Care setting for antibiotic treatment
- Antibiotic management for suspected or confirmed meningitis in babies in a neonatal unit
- Therapeutic drug monitoring for gentamicin

Scope

Disease/Condition(s)

Early-onset neonatal bacterial infection (infection with onset within 72 hours of birth)

Guideline Category

Counseling

Diagnosis

Evaluation

Management

Risk Assessment

Screening

Treatment

Clinical Specialty

Family Practice

Infectious Diseases

Internal Medicine

Nursing

Obstetrics and Gynecology

Pediatrics

Intended Users

Advanced Practice Nurses

Allied Health Personnel

Health Care Providers

Hospitals

Nurses

Patients

Physician Assistants

Physicians

Guideline Objective(s)

To offer best practice advice on the care of babies who are at risk of or who have an early-onset neonatal infection (that is, onset of infection within 72 hours of birth)

Target Population

- Unborn babies who may be at risk of early-onset neonatal bacterial infection (onset of infection before 72 hours of age)
- Newborn babies (term and preterm) with an increased risk of infection because of potential transmission of bacteria from the mother
- Newborn babies (term and preterm) with suspected or confirmed early-onset neonatal bacterial infection
- Preterm babies will receive special consideration because they have an increased risk of infection, and because they may need different strategies for the prevention, diagnosis, and treatment of infection

Note: These guidelines are not intended for use in the following populations:

Babies with suspected or confirmed late-onset neonatal bacterial infection (onset of infection after 72 hours of age)

Babies with suspected or confirmed non-bacterial infections

Babies with suspected or confirmed bacterial infection resulting from therapeutic interventions such as surgery

Babies with suspected or confirmed syphilis

Interventions and Practices Considered

Assessment/Diagnosis

1. Provision of information and support for parents/carers
2. Identification of infection risk factors and clinical indicators
3. Measurement of C-reactive protein levels
4. Lumbar puncture and cerebrospinal fluid culture
5. Eye discharge swabbing and microbiological investigation
6. Blood culture

Management/Treatment

1. Antibiotic therapy
 - Intrapartum prophylaxis
 - Clindamycin
 - Benzylpenicillin
 - Flucloxacillin
 - Gentamicin
 - Cefotaxime
 - Duration of antibiotic treatment
2. Therapeutic drug monitoring for gentamicin
3. Regular reassessment of clinical condition
4. Clinical microbiology or paediatric infectious disease consultation
5. Intravenous antibiotics outside of hospital setting

Major Outcomes Considered

- Neonatal mortality
- Neonatal morbidity, including infection, respiratory distress syndrome, intraventricular haemorrhage, necrotising enterocolitis, length of hospital stay, and complications of therapy

- Health-related quality of life of the baby
- Impact on the baby's family including subsequent pregnancies
- Antibiotic resistance
- Cost-effectiveness

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Note from the National Guideline Clearinghouse (NGC): This guideline was developed by the National Collaborating Centre for Women's and Children's Health (NCC-WCH), on behalf of the National Institute for Health and Clinical Excellence (NICE). See the "Availability of Companion Documents" field for the full version of this guidance.

Developing Review Questions and Protocols and Identifying Evidence

The Guideline Development Group (GDG) formulated review questions based on the scope and prepared a protocol for each review question (see Appendix D of the full version of the original guideline document). These formed the starting point for systematic reviews of relevant evidence. Published evidence was identified by applying systematic search strategies (see Appendix E of the full version of the original guideline document) to the following databases: Medline, Medline In-Process, Embase, and three Cochrane databases (Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, and the Database of Abstracts of Reviews of Effects). Searches to identify economic studies were undertaken using Medline, Embase, the Cochrane Central Register of Controlled Trials, the National Health Service Economic Evaluation Database (NHS EED), and the Health Technology Assessment (HTA) database.

Where appropriate, review questions were grouped together for searching. The searches were not limited by countries in which studies were conducted, but studies conducted outside the European Union (EU), the USA, Canada, Australia, and New Zealand were excluded manually from the search results because they were viewed to be less relevant to the development of guideline recommendations. In geographical settings other than those listed above, causative organisms, prevalence rates, and clinical practice are likely to be different to those in the United Kingdom (UK). Different virulence factors are likely to alter the nature and timing of the patient response, and prevalence rates need to be homogenous to allow interpretation of statistics such as diagnostic test accuracy (whether to put a particular test into clinical practice); in geographical settings other than those listed above there is significant risk of heterogeneity in prevalence rates.

The initial search for the review of risk factors in the baby (including symptoms and signs of infection) resulted in a very large number of articles for consideration, and so the search was limited to articles published in or after 2000 to ensure a manageable workload for the GDG and the NCC-WCH technical team. The remaining searches were not limited by date. Animal studies were excluded from Medline and both Medline and Embase were limited to English-language studies only. Generic and specially developed search filters were used to identify particular study designs, such as randomised controlled trials. There was no systematic attempt to search grey literature (conference abstracts, theses, or unpublished trials), nor was hand searching of journals not indexed on the databases undertaken.

Towards the end of the guideline development process, the searches were updated and re-executed to include evidence published and indexed in the databases before 22 September 2011.

Number of Source Documents

Not stated

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Grading of Recommendations Assessment, Development and Evaluation (GRADE) Scheme

High: Further research is very unlikely to change the confidence in the estimate of effect

Moderate: Further research is likely to have an important impact on the confidence in the estimate of effect and may change the estimate

Low: Further research is very likely to have an important impact on the confidence in the estimate of effect and is likely to change the estimate

Very low: Any estimate of effect is very uncertain

Methods Used to Analyze the Evidence

Meta-Analysis

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

Note from the National Guideline Clearinghouse (NGC): This guideline was developed by the National Collaborating Centre for Women's and Children's Health (NCC-WCH), on behalf of the National Institute for Health and Clinical Excellence (NICE). See the "Availability of Companion Documents" field for the full version of this guidance.

Reviewing and Synthesising Evidence

Evidence relating to clinical effectiveness was reviewed and synthesised according to the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach. In this approach, the quality of the evidence identified for each outcome listed in the review protocol is assessed according to the factors listed below and an overall quality rating (high, moderate, low, or very low) is assigned by combining the ratings for the individual factors.

- Study design (as an indicator of intrinsic bias; this determines the initial quality rating)
- Limitations in the design or execution of the study (including concealment of allocation, blinding, loss to follow up; these can reduce the quality rating)
- Inconsistency of effects across studies (this can reduce the quality rating where more than one study is considered for the same outcome)
- Indirectness (the extent to which the available evidence fails to address the specific review question; this can reduce the quality rating)
- Imprecision (the extent to which the point estimate or its confidence interval [CI] reflects a statistically significant or clinically important difference; this can reduce the quality rating)
- Other considerations (including large magnitude of effect, evidence of a dose-response relationship or confounding variables likely to have reduced the magnitude of an effect; these can increase the quality rating in observational studies, provided no downgrading for other features has occurred).

For each review question the highest available level of evidence was sought. Where appropriate, for example, if a systematic review, meta-analysis, or randomised controlled trial (RCT) was identified to answer a question directly, studies of a weaker design were not considered. Where systematic reviews, meta-analyses and RCTs were not identified, other appropriate experimental or observational studies were sought. For diagnostic tests, test evaluation studies examining the performance of the test were used if the accuracy of the test was required, but where an evaluation of the effectiveness of the test in the clinical management of the condition was required, evidence from RCTs or cohort studies was optimal. For studies evaluating the accuracy of a diagnostic test, sensitivity, specificity, and likelihood ratios (LRs) for positive and negative test results (LR+ and LR-, respectively) were calculated or quoted where possible (see Table 3.1 of the full version of the original guideline document).

The number of studies identified for each review question is summarised in Appendix F of the full version of the original guideline document. Some studies were excluded from the guideline reviews after obtaining copies of the corresponding publications because they did not meet inclusion criteria specified by the GDG (see Appendix G). The characteristics of each included study were summarised in evidence tables for each review question (see Appendix H of the full version of the original guideline document). Where possible, dichotomous outcomes were presented as

relative risks (RRs) or odds ratios (ORs) with 95% confidence intervals (CIs), and continuous outcomes were presented as mean differences with 95% CIs or standard deviations (SDs). RRs were prioritised by the GDG for dichotomous outcomes because they have a natural interpretation.

The body of evidence identified for each review question (or part of a review question) was presented in the form of a GRADE evidence profile summarising the quality of the evidence and the findings (pooled relative and absolute effect sizes and associated CIs). Where possible, the body of evidence corresponding to each outcome specified in the review protocol was subjected to quantitative meta-analysis. In such cases, pooled effect sizes were presented as pooled RRs, pooled ORs, or weighted mean differences (MDs). By default, meta-analyses were conducted by fitting random effects models because the study populations and interventions evaluated were viewed by the GDG as being intrinsically heterogeneous and different to the populations and interventions of interest to the GDG (for example, the gestational ages or postnatal ages of babies varied greatly between included studies, as did regimens for administration of antibiotics, even when the same antibiotic was being used). Where quantitative meta-analysis could not be undertaken, the range of effect sizes reported in the included studies was presented. Forest plots for all meta-analyses conducted for the guideline are presented in Appendix I of the full version of the original guideline document. GRADE findings are presented in full in Appendix J of the full version of the original guideline document; abbreviated versions (summary of findings without the individual components of the quality assessment) are presented in the full version of the original guideline document.

Various approaches may be used to assess imprecision in the GRADE framework. In this guideline, dichotomous outcomes in intervention studies were downgraded in terms of imprecision when the total number of events was less than 300 and continuous outcomes were downgraded when the total sample size was less than 400. These are default thresholds used in GRADE for intervention studies. For diagnostic test accuracy studies, evidence was downgraded in terms of imprecision when the width of the 95% CI for either sensitivity or specificity was 40 percentage points or more, or if the CI for any of sensitivity, specificity, LR+ or LR– was not reported or not calculable. These thresholds and decision rules have been used in other NICE clinical guidelines.

Incorporating Health Economics

The aims of the health economic input to the guideline were to inform the GDG of potential economic issues relating to the prevention and treatment of early-onset neonatal infection, and to ensure that recommendations represented a cost-effective use of healthcare resources. Health economic evaluations aim to integrate data on benefits (ideally in terms of quality adjusted life years [QALYs]), harms and costs of different care options.

The GDG prioritised a number of review questions where it was thought that economic considerations would be particularly important in formulating recommendations. Systematic searches for published economic evidence were undertaken for these questions. For economic evaluations, no standard system of grading the quality of evidence exists and included papers were assessed using a quality assessment checklist based on good practice in economic evaluation. Reviews of the (very limited) relevant published health economic literature are presented alongside the clinical effectiveness reviews.

Health economic considerations were aided by original economic analysis undertaken as part of the development process. For this guideline the areas prioritised for economic analysis were:

- Reacting to different risk factors, singly or in combination
- Investigations (tests) such as: C-reactive protein; procalcitonin; full blood count; white blood cell (WBC) count; platelet count; lumbar puncture; polymerase chain reaction (PCR); investigations specific to urinary tract infection (for example suprapubic aspirates); surface swabs; and gastric aspirates
- Intrapartum antibiotic prophylaxis for the prevention of early-onset neonatal infection compared with no treatment
- Antibiotic treatment regimens in babies with:
 - Confirmed early-onset neonatal infection (bacterial cause identified)
 - Presumed symptomatic infection, but no bacterial cause identified
 - Initial clinical suspicion of infection, but no continuing clinical concerns and results of all investigations normal
 - Asymptomatic babies receiving prophylactic treatment
- Cost-effectiveness of different care settings, taking into account the woman's choice as well as the feasibility of delivering a safe standard of care in different settings

Details of the health economic analyses conducted for the guideline are presented in Chapter 13 of the full version of the original guideline document.

Methods Used to Formulate the Recommendations

Expert Consensus (Nominal Group Technique)

Description of Methods Used to Formulate the Recommendations

Note from the National Guideline Clearinghouse (NGC): This guideline was developed by the National Collaborating Centre for Women's and Children's Health (NCC-WCH), on behalf of the National Institute for Health and Clinical Excellence (NICE). See the "Availability of Companion Documents" field for the full version of this guidance.

Evidence to Recommendations

For each review question recommendations for clinical care were derived using, and linked explicitly to, the evidence that supported them. In the first instance, informal consensus methods were used by the Guidelines Development Group (GDG) to agree short clinical and, where appropriate, cost effectiveness evidence statements, which were presented alongside the evidence profiles. Statements summarising the GDG's interpretation of the evidence and any extrapolation from the evidence used to form recommendations were also prepared to ensure transparency in the decision-making process. The criteria used in moving from evidence to recommendations were:

- Relative value placed on the outcomes considered
- Consideration of the clinical benefits and harms
- Consideration of net health benefits and resource use
- Quality of the evidence
- Other considerations (including equalities issues)
- Key conclusions

In areas where no substantial clinical research evidence was identified, the GDG members considered other evidence-based guidelines and consensus statements or used their collective experience to identify good practice. The health economics justification in areas of the guideline where the use of National Health Service (NHS) resources (interventions, including tests and other investigations) was considered was based on GDG consensus in relation to the likely cost effectiveness implications of the recommendations. The GDG also identified areas where evidence to answer its review questions was lacking and used this information to formulate recommendations for future research.

Towards the end of the guideline development process formal consensus methods were used to consider all the clinical care recommendations and research recommendations that had been drafted previously. The GDG identified ten 'key priorities for implementation' (key recommendations) and five high-priority research recommendations. The key priorities for implementation were those recommendations thought likely to have the biggest impact on the prevention and treatment of early-onset neonatal infection and outcomes in the NHS as a whole; these were selected using a variant of the nominal group technique (see the NICE guidelines manual). The priority research recommendations were also selected using a variant of the nominal group technique.

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

Review of Published Health Economic Evidence

A single Health Technology Assessment (HTA) was reviewed. The most cost-effective option reported in the HTA was to provide routine antibiotic prophylaxis to all women without screening. As this was thought unlikely to be acceptable to most women and midwives, this option was discarded and the next best alternative was considered; this was screening, based on a culture test at 35–37 weeks' gestation, with the provision of antibiotics to all women who screen positive, assuming that all women in preterm labour would receive prophylaxis. The results were very sensitive to very small increases in costs and changes in other assumptions. An article based on the HTA was published in 2010. The economic analysis reported similar results. Routine untargeted intrapartum antibiotics prophylaxis was the most cost-effective strategy, with an incremental cost effectiveness ratio (ICER) of £15,815 per quality adjusted life year (QALY) when compared with no screening and no intrapartum antibiotic prophylaxis (all other strategies were removed by simple dominance and extended dominance). Tables 13.1 and 13.2 in the full version of the original guideline document present the results relevant to risk factors and intrapartum prophylaxis.

The Public Health Laboratory Service (PHLS) 2001 interim guideline was referenced for the assumption that all women presenting in labour before 35–37 weeks of gestation would receive intrapartum prophylaxis. This was based on US data (in the absence of available United Kingdom

[UK] data) and the Royal College of Obstetricians and Gynaecologists (RCOG) report that they have not been widely adopted in the UK (RCOG 2003). The first edition of the RCOG guideline (RCOG 2003) recommended that antibiotic prophylaxis for group B streptococcus (GBS) was unnecessary for women with preterm rupture of membranes unless they were in established labour. The second edition of the RCOG guideline (RCOG 2012) recommends that women presenting in established preterm labour with intact membranes and no other risk factors for GBS should not routinely be offered intrapartum antibiotic prophylaxis unless they are known to be colonised with GBS.

See the full version of the original guideline document for additional detail on the review of published health economic evidence.

Health Economic Analysis

The clinical review of symptoms, signs, and risk factors in newborn babies as predictors of early-onset neonatal infection did not identify evidence that demonstrated that any single symptom or sign would be useful for predicting infection. In the absence of evidence, the guideline development group (GDG) consensus was that specific risk factors, symptoms, and signs identified in isolation were effective 'red flags' for the immediate initiation of antibiotic treatment. In addition, the GDG view was that the identification of more than one risk factor, symptom, or sign was suggestive of infection, and antibiotics should be started immediately before testing for sepsis. Diagnostic tests would then be undertaken to determine which babies should continue to receive antibiotic treatment (that is, to determine which babies have confirmed infection). These tests can also determine whether and when to stop antibiotic treatment in babies who have no infection.

The remaining group of babies have only one risk factor which is not considered to be a 'red flag'. The GDG's view was that immediate antibiotic treatment in this group was not necessary. Diagnostic tests can be undertaken to determine which asymptomatic babies may have an infection, and such babies could then begin antibiotic treatment given the increased effectiveness of antibiotics started early in neonates with sepsis who have not yet developed symptoms or signs.

Although this approach was proposed by the GDG based on consensus on clinical effectiveness, the cost effectiveness of alternative strategies for asymptomatic babies with risk factors for sepsis required further health economic evaluation. In addition, the GDG required a health economic analysis to determine the optimal strategy of C-reactive protein (CRP) testing for babies with suspected sepsis.

*What Is the Most Cost-Effective Strategy of CRP Testing To Rule Out Early-Onset Neonatal Infection in Babies with Suspected Sepsis?
What Duration of Antibiotic Treatment Should Be Given to Babies with Suspected Sepsis?*

Conclusions of cost analysis: A testing strategy of two CRP tests (at presentation with suspected infection and 24 hours afterwards), with 36 hours of antibiotics, is likely to be cost saving compared to current practice where more than 36 hours of antibiotics are given for suspected sepsis and more than two CRP tests are performed. This strategy will allow babies who have no infection to be discharged earlier than is currently the case.

See chapter 13 of the full version of the original guideline document for additional details of the cost analysis.

Is It Cost-Effective To Test and Treat Asymptomatic Babies with Only One Risk Factor (Compared to Observation with Treatment Given Only When Symptoms and Signs Develop)?

Conclusions of cost analysis: The consensus of the GDG was that the evidence for the diagnostic test was not strong enough, and the results of the analysis showed too much uncertainty to recommend the additional blood test for this group of babies. Further research in this area is needed.

See chapter 13 of the full version of the original guideline document for additional details of the cost analysis.

Method of Guideline Validation

External Peer Review

Internal Peer Review

Description of Method of Guideline Validation

The guideline was validated through two consultations.

1. The first draft of the guideline (the full guideline, National Institute for Health and Clinical Excellence [NICE] guideline, and Quick Reference Guide) were consulted with Stakeholders and comments were considered by the Guideline Development Group (GDG)
2. The final consultation draft of the full guideline, the NICE guideline and the Information for the Public were submitted to stakeholders for final comments.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of evidence supporting the recommendations is not specifically stated.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Safe and effective use of antibiotics (either individual drugs or classes of drugs to be used alone or in combination) and treatment regimens for early-onset neonatal bacterial infection (infection with onset within 72 hours of birth)

Potential Harms

- The guideline development group (GDG) agreed that a potential harm of basing clinical management solely on the presence or absence of antenatal or perinatal risk factors would be unnecessary exposure to antibiotics in babies who do not have an infection. Additional associated harms would be a prolonged hospital stay for more babies (thus having an impact on the baby's family), the possibility of adverse effects of antibiotics on the baby's developing immune system and intestinal flora, and the broader risk of antibiotic resistance. Moreover, increased medicalisation of birth might decrease parental and carer satisfaction. There would also be an impact on care setting, as women whose babies are considered to be at increased risk might be advised to give birth in hospital.
- The GDG considered the consequences of accurate and inaccurate diagnoses on the care of babies. The group recognised the importance of treating all babies that really have an early-onset neonatal infection early and adequately, but also that inaccurate diagnoses (corresponding to false positive test results) or overtreatment of babies with infection (those with a true positive result) would cause unnecessary exposure to antibiotics, hospital stays and anxiety for babies' families. The GDG also acknowledged the broader harm of increased antibiotic resistance with over-prescription of antibiotics, but considered that the greatest harm would be delayed or missed identification and treatment of early-onset neonatal infection in those babies that really have such an infection (corresponding to a false negative test result).
- The GDG gave special deliberation to lumbar puncture, balancing the clinical imperative for prompt identification of bacterial meningitis to facilitate effective treatment, whether and when cerebrospinal fluid (CSF) tests would be needed in addition to other investigations, and the additional risks and inconvenience associated with lumbar puncture because of the invasive nature of the procedure.
- It is important to choose the optimal antibiotic regimen for empirical treatment of early-onset neonatal infection to be able to target the most likely bacterial organisms responsible. However, drugs that may be considered most effective might have other advantages or disadvantages, for example bacterial resistance. Development of bacterial resistance needs to be considered in relation to the balance between the needs of a baby with early-onset neonatal infection in the present and other babies in the future who might acquire an infection with resistant bacteria. Where the evidence does not indicate a greater clinical effectiveness for any one antibiotic regimen, it is reasonable to use an antibiotic regimen that is associated with a lower potential for the development of antibiotic resistance.
- Specifying the optimal duration of antibiotic treatment will ensure that the bacteria causing an infection have been eliminated. Stopping antibiotic treatment too early (when there is still clinical evidence of infection) can be very harmful for the baby and could lead to a relapse of the disease. However, continuing unnecessary antibiotic treatment may influence the development of the gastrointestinal tract and immune system and promote selection of antibiotic-resistant micro-organisms.
- The GDG considered the relative weight to be given to the effectiveness of gentamicin treatment (for example in terms of the bactericidal effect of gentamicin against a target micro-organism) and safety considerations, particularly in relation to potential damage to hearing and kidney function.
- The GDG was aware that in the United Kingdom there is an increasing tendency for children and adults with infection to be discharged from hospital before the end of antibiotic treatment, allowing treatment for early-onset neonatal infection be completed at home (in the community antibiotics can be administered by a community nurse). The GDG emphasised as a potential harm the fact that some community services might not be able to provide a necessarily safe standard level of care. Moreover, some parents and carers might not be able to care for a baby at home, or they might feel more reassured if the baby received care in a hospital setting.
- Side effects of antibiotics in the baby or the mother
- See the chapters 4-12 in the full version of the original guideline document (see the "Availability of Companion Documents" field) for

additional details on potential harms associated with recommendations.

Qualifying Statements

Qualifying Statements

- This guidance represents the view of the National Institute for Health and Clinical Excellence (NICE), which was arrived at after careful consideration of the evidence available. Healthcare professionals are expected to take it fully into account when exercising their clinical judgement. However, the guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or guardian or carer, and informed by the summary of product characteristics of any drugs they are considering.
- Implementation of this guidance is the responsibility of local commissioners and/or providers. Commissioners and providers are reminded that it is their responsibility to implement the guidance, in their local context, in light of their duties to avoid unlawful discrimination and to have regard to promoting equality of opportunity. Nothing in this guidance should be interpreted in a way that would be inconsistent with compliance with those duties.
- The guideline will assume that prescribers will use a drug's summary of product characteristics to inform their decisions for individual women and babies. Where dosages recommended in the guideline are based on evidence that is not reflected in the summary of product characteristics, this is indicated in footnotes to the recommendations.

Implementation of the Guideline

Description of Implementation Strategy

The National Institute for Health and Clinical Excellence (NICE) has developed tools to help organisations implement this guidance. These are available on the NICE Web site (<http://guidance.nice.org.uk/CG149> ; see also the "Availability of Companion Documents" field).

Key Priorities for Implementation

The Guideline Development Group identified ten 'key priorities for implementation' (key recommendations). The key priorities for implementation were those recommendations thought likely to have the biggest impact on the prevention and treatment of early-onset neonatal infection and outcomes in the National Health Service (NHS) as a whole; these were selected using a variant of the nominal group technique (see the NICE guidelines manual, 2009; see the "Availability of Companion Documents" field).

The following recommendations have been identified as priorities for implementation.

Information and Support

If there have been any concerns about early-onset neonatal infection before a baby is discharged, advise the parents and carers verbally and in writing that they should seek medical advice (for example, from NHS Direct, their general practice, or an accident and emergency department) if they are concerned that the baby:

- Is showing abnormal behaviour (for example, inconsolable crying or listlessness), or
- Is unusually floppy, or
- Has developed difficulties with feeding or with tolerating feeds, or
- Has an abnormal temperature unexplained by environmental factors (lower than 36°C or higher than 38°C), or
- Has rapid breathing, or
- Has a change in skin colour

Risk Factors for Infection and Clinical Indicators of Possible Infection

Use the following framework based on risk factors and clinical indicators, including red flags (see Tables 1 and 2 in the "Major Recommendations" field), to direct antibiotic management decisions:

- In babies with any red flags, or with two or more 'non-red flag' risk factors or clinical indicators (see Tables 1 and 2 in the "Major Recommendations" field), perform investigations (see the related recommendations in the Antibiotics for Suspected Infection section in the "Major Recommendations" field) and start antibiotic treatment. Do not delay starting antibiotics pending the test results (see the related recommendations in the Antibiotics for Suspected Infection section in the "Major Recommendations" field).
- In babies without red flags and only one risk factor or one clinical indicator, using clinical judgement, consider:
 - Whether it is safe to withhold antibiotics, and
 - Whether it is necessary to monitor the baby's vital signs and clinical condition – if monitoring is required continue it for at least 12 hours (at 0, 1, and 2 hours and then 2-hourly for 10 hours)
- If a baby needs antibiotic treatment it should be given as soon as possible and always within 1 hour of the decision to treat.

Intrapartum Antibiotics

Offer intrapartum antibiotic prophylaxis using intravenous benzylpenicillin to prevent early-onset neonatal infection for women who have had:

- A previous baby with an invasive group B streptococcal infection
- Group B streptococcal colonisation, bacteriuria, or infection in the current pregnancy

Investigations before Starting Antibiotics in the Baby

Measure the C-reactive protein concentration at presentation when starting antibiotic treatment in babies with risk factors for infection or clinical indicators of possible infection.

Antibiotics for Suspected Infection

Use intravenous benzylpenicillin with gentamicin as the first-choice antibiotic regimen for empirical treatment of suspected infection unless microbiological surveillance data reveal local bacterial resistance patterns indicating a different antibiotic.

Investigations during Antibiotic Treatment

In babies given antibiotics because of risk factors for infection or clinical indicators of possible infection, measure the C-reactive protein concentration 18–24 hours after presentation.

Decisions 36 Hours after Starting Antibiotic Treatment

In babies given antibiotics because of risk factors for infection or clinical indicators of possible infection consider stopping the antibiotics at 36 hours if:

- The blood culture is negative, and
- The initial clinical suspicion of infection was not strong, and
- The baby's clinical condition is reassuring with no clinical indicators of possible infection, and
- The levels and trends of C-reactive protein concentration are reassuring

Consider establishing hospital systems to provide blood culture results 36 hours after starting antibiotics to facilitate timely discontinuation of treatment and discharge from hospital.

Care Setting

When deciding on the appropriate care setting for a baby, take into account the baby's clinical needs and the competencies necessary to ensure safe and effective care (for example, the insertion and care of intravenous cannulas).

Implementation Tools

Audit Criteria/Indicators

Clinical Algorithm

Foreign Language Translations

Patient Resources

Resources

Slide Presentation

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

IOM Domain

Effectiveness

Patient-centeredness

Safety

Timeliness

Identifying Information and Availability

Bibliographic Source(s)

National Collaborating Centre for Women's and Children's Health. Antibiotics for early-onset neonatal infection. London (UK): National Institute for Health and Clinical Excellence (NICE); 2012 Aug. 40 p. (Clinical guideline; no. 149).

Adaptation

Some recommendations in this guideline have been adapted from:

- National Collaborating Centre for Women's and Children's Health. Intrapartum care. Care of healthy women and their babies during childbirth. London (UK): National Institute for Health and Clinical Excellence (NICE); 2007 Sep. 65 p. (Clinical guideline; no. 55).
- National Collaborating Centre for Women's and Children's Health. Bacterial meningitis and meningococcal septicaemia. Management of bacterial meningitis and meningococcal septicaemia in children and young people younger than 16 years in primary and secondary care. London (UK): National Institute for Health and Clinical Excellence (NICE); 2010 Jun. 45 p. (Clinical guideline; no. 102).

Date Released

2012 Aug

Guideline Developer(s)

National Collaborating Centre for Women's and Children's Health - National Government Agency [Non-U.S.]

Source(s) of Funding

National Institute for Health and Clinical Excellence (NICE)

Guideline Committee

Guideline Development Group

Composition of Group That Authored the Guideline

Guideline Development Group Members: Mark Turner (*Chair*), Senior Lecturer and Consultant in Neonatology, University of Liverpool and Liverpool Women's NHS Foundation Trust; Gareth Barrett, Midwife Practitioner, Chelsea and Westminster NHS Trust (until March 2011); Neil Caldwell, Consultant Pharmacist, Children's Services, Wirral University Teaching Hospital NHS Foundation Trust; James Gray, Consultant Microbiologist, Birmingham Children's Hospital NHS Foundation Trust and Birmingham Women's NHS Foundation Trust; Paul Heath, Professor of Paediatric Infectious Diseases, Honorary Consultant, Division of Clinical Sciences and Vaccine Institute, St George's, University of London; Vanessa Hodge, Senior Midwife, Heatherwood and Wexham Park Hospitals Trust, Slough (from August 2011); David Howe, Consultant and Honorary Senior Lecturer in FetoMaternal Medicine, University Hospital Southampton NHS Foundation Trust; Marie Hubbard, Neonatal Research Nurse, University Hospitals of Leicester NHS Trust; Jane Plumb, Parent member, Group B Strep Support

Financial Disclosures/Conflicts of Interest

All guideline development group (GDG) members' potential and actual conflicts of interest were recorded on declaration forms provided by the National Institute for Health and Clinical Excellence (NICE) (summarised in Appendix B of the full version of the original guideline document). None of the interests declared by GDG members constituted a material conflict of interest that would influence recommendations developed by the GDG.

Guideline Status

This is the current release of the guideline.

Guideline Availability

Electronic copies: Available from the [National Institute for Health and Clinical Excellence \(NICE\) Web site](#) .

Availability of Companion Documents

The following are available:

- Antibiotics for early-onset neonatal infection: Antibiotics for the prevention and treatment of early-onset neonatal infection. Full guideline. London (UK): National Institute for Health and Clinical Excellence (NICE); 2012 Aug. 320 p. (Clinical Guideline; no. 149). Electronic copies: Available in Portable Document Format (PDF) from the [National Institute for Health and Clinical Excellence \(NICE\) Web site](#) .
- Antibiotics for early-onset neonatal infection: Antibiotics for the prevention and treatment of early-onset neonatal infection. Appendices. London (UK): National Institute for Health and Clinical Excellence (NICE); 2012 Aug. (Clinical Guideline; no. 149). Electronic copies: Available in PDF from the [NICE Web site](#) .
- Antibiotics for early-onset neonatal infection. Costing report. London (UK): National Institute for Health and Clinical Excellence (NICE); 2012 Aug. 21 p. (Clinical Guideline; no. 149). Electronic copies: Available in PDF from the [NICE Web site](#) .
- Antibiotics for early-onset neonatal infection. Costing template. London (UK): National Institute for Health and Clinical Excellence (NICE); 2012 Aug. (Clinical Guideline; no. 149). Electronic copies: Available from the [NICE Web site](#) .
- Antibiotics for early-onset neonatal infection. Clinical audit tools. London (UK): National Institute for Health and Clinical Excellence (NICE); 2012 Aug. (Clinical Guideline; no. 149). Electronic copies: Available from the [NICE Web site](#) .

- Antibiotics for early-onset neonatal infection. Electronic audit tool. London (UK): National Institute for Health and Clinical Excellence (NICE); 2012 Aug. (Clinical Guideline; no. 149). Electronic copies: Available from the [NICE Web site](#) .
- Antibiotics for early-onset neonatal infection. Baseline assessment tool. London (UK): National Institute for Health and Clinical Excellence (NICE); 2012 Aug. (Clinical Guideline; no. 149). Electronic copies: Available from the [NICE Web site](#) .
- Antibiotics for early-onset neonatal infection. Slide set. London (UK): National Institute for Health and Clinical Excellence (NICE); 2012 Aug. (Clinical Guideline; no. 149). Electronic copies: Available from the [NICE Web site](#) .
- Antibiotics for early-onset neonatal infection. Podcast. London (UK): National Institute for Health and Clinical Excellence (NICE); 2012 Aug. (Clinical Guideline; no. 149). Electronic copies: Available from the [NICE Web site](#) .
- The guidelines manual 2009. London (UK): National Institute for Health and Clinical Excellence (NICE); 2009 Jan. Electronic copies: Available in Portable Document Format (PDF) from the [NICE Archive Web site](#) .

Patient Resources

The following is available:

- Antibiotics for early-onset neonatal infection. Understanding NICE guidance. Information for people who use NHS services. London (UK): National Institute for Health and Clinical Excellence; 2012 Aug. 15 p. (Clinical Guideline; no. 149). Electronic copies: Available in Portable Document Format (PDF) from the [National Institute for Health and Clinical Excellence \(NICE\) Web site](#) . Also available in Welsh from the [NICE Web site](#) .

Please note: This patient information is intended to provide health professionals with information to share with their patients to help them better understand their health and their diagnosed disorders. By providing access to this patient information, it is not the intention of NGC to provide specific medical advice for particular patients. Rather we urge patients and their representatives to review this material and then to consult with a licensed health professional for evaluation of treatment options suitable for them as well as for diagnosis and answers to their personal medical questions. This patient information has been derived and prepared from a guideline for health care professionals included on NGC by the authors or publishers of that original guideline. The patient information is not reviewed by NGC to establish whether or not it accurately reflects the original guideline's content.

NGC Status

This summary was completed by ECRI Institute on November 12, 2102.

The National Institute for Health and Clinical Excellence (NICE) has granted the National Guideline Clearinghouse (NGC) permission to include summaries of their clinical guidelines with the intention of disseminating and facilitating the implementation of that guidance. NICE has not yet verified this content to confirm that it accurately reflects that original NICE guidance and therefore no guarantees are given by NICE in this regard. All NICE clinical guidelines are prepared in relation to the National Health Service in England and Wales. NICE has not been involved in the development or adaptation of NICE guidance for use in any other country. The full versions of all NICE guidance can be found at [www.nice.org.uk](#) .

Copyright Statement

This NGC summary is based on the original guideline, which is subject to the guideline developer's copyright restrictions.

Disclaimer

NGC Disclaimer

The National Guideline Clearinghouse[®],[©] (NGC) does not develop, produce, approve, or endorse the guidelines represented on this site.

All guidelines summarized by NGC and hosted on our site are produced under the auspices of medical specialty societies, relevant professional associations, public or private organizations, other government agencies, health care organizations or plans, and similar entities.

Guidelines represented on the NGC Web site are submitted by guideline developers, and are screened solely to determine that they meet the NGC Inclusion Criteria which may be found at <http://www.guideline.gov/about/inclusion-criteria.aspx>.

NGC, AHRQ, and its contractor ECRI Institute make no warranties concerning the content or clinical efficacy or effectiveness of the clinical practice guidelines and related materials represented on this site. Moreover, the views and opinions of developers or authors of guidelines represented on this site do not necessarily state or reflect those of NGC, AHRQ, or its contractor ECRI Institute, and inclusion or hosting of guidelines in NGC may not be used for advertising or commercial endorsement purposes.

Readers with questions regarding guideline content are directed to contact the guideline developer.